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To investigate the effects of visual defect on the reading and psycholinguistic processes, results were obtained for partially seeing children (grades 1 to 4, mean IQ 100) on the Monroe Reading Examination, Gates Speed and Accuracy Tests, Illinois Test of Psycholinguistic Abilities (ITPA), and Stanford-Binet Intelligence Scale. Reading scores were (1) below grade level for grade 4 and at grade level for grade 3, (2) lowest on oral reading and highest on the Gates comprehension tests, and (3) below average for mental age, grade placement, and reading speed, but higher than average in accuracy. IQ was related positively with reading in relation to grade level, but negatively with reading in relation to mental age. The subjects made no excessive errors of any kind; error types and the degree of visual defect did not differ significantly. However, children with refractive defects read less well than the other subjects. On the ITPA, the subjects performed significantly less well than normals n visual decoding, motor encoding, visual-motor sequential, and visual-motor association subtests, but did not differ on the auditory-vocal channel subtests. ITPA performance was related to eye condition only through the indirect effect of visual acuity. Reading achievement was positively correlated with the three ITPA subtests at the automatic-sequential level. Eight figures, 12 tables, four case histories, and 32 references are provided. (JD)

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Reading and Psycholinguistic Processes of Partially Seeing Children

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NO. 5

The Council for Exceptional Children, NEA

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RESEARCH MONOGRAPH

BARBARA D. BATEMAN

EC 000235

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READING AND PSYCHOLINGUISTIC PROCESSES OF PARTIALLY SEEING CHILDREN

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Foreword

Although in the area of the visually handicapped there has been considerable research on blind children, the partially seeing have been relatively neglected from a research point of view except for medical descriptions of visual defects.

From an educational viewpoint there has been great need for studies on the psychological and educational processes of partially seeing children. We have not had adequate knowledge either about the actual educational achievement of these children or about the learning processes which underlie achievement.

Dr. Bateman's study explores the reading achievement, reading processes, and psycholinguistic processes of partially seeing children and examines the ways in which reading and psycholinguistic functioning are related to each other and to the kind and extent of visual defect. This study is based on more than ninety percent of the partially seeing children, grades one through four, enrolled in special class and resource room programs in the State of Illinois outside of Chicago. The findings appear applicable to partially seeing children wherever admission to special programs is based on criteria similar to those in Illinois, presumably throughout the country.

This study was supported in part by a grant from the Psychiatric Training and Research Fund of the Illinois State Department of Mental Health and would not have been possible without the excellent cooperation of Mrs. Dorothy Bryan, Illinois State Department of Public Instruction, and teachers of the partially seeing in twenty classes throughout the state.

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1 | Introduction

Special education programs have been provided for partially seeing children for more than fifty years. The establishment and modifications of these special practices have been based primarily on the experience of workers in the field rather than on psychological or educational research on the achievement or psychological processes underlying the achievement of these children.

Statement of the Problem

The purpose of this study was to investigate the effect of limited vision on the reading and psycholinguistic processes of partially seeing children. In the absence of any previous research in this area, it was believed that a normative survey approach would yield more information at this stage than would be obtained by limiting the study to the testing of preformulated hypotheses. Five questions were posed:

1. To what extent does the reading achievement of partially seeing children differ from that of normal children?
2. Is there a qualitative difference between the reading processes of partially seeing children and normal children as evidenced by the types of errors made?
3. What relations exist between extent or type of visual defect and particular patterns of reading?
4. How do the psycholinguistic processes of partially seeing children differ from those of normal children?
5. What kinds of relations exist between the nature of psycholinguistic processes and that of reading processes of partially seeing children?

Review of the Literature

Although comparatively extensive research is available concerning both the blind and those with very mild visual defects, the partially seeing as a group have not received the research attention given these other groups. Twenty years ago, Pintner reviewed the literature regarding partially seeing children and concluded that, "About the children themselves from a psychological point of view we know practically nothing" (1941, p. 259-260). Commenting on this statement fifteen years later,

This monograph is based upon the author's unpublished doctoral dissertation, Reading and Psycholinguistic Processes of Partially Sighted Children, University of Illinois, Urbana, 1962.

Lowenfeld added, "Since then conditions have not changed to any considerable extent" (1955, p. 273).

Factors contributing to the paucity of research regarding the partially seeing as a group include: (a) partially seeing children appear to function as normally seeing children much, or even most, of the time; (b) the educational provisions for this group are not radically different from those for normal children; and (c) apparently few investigators have been interested in the partially seeing.

Only two major surveys of children in classes for the partially seeing have been conducted. The first was reported thirty years ago by Myers (1930) and the second, dealing with visual conditions, by Kerby (1952). Myers' study, which used the questionnaire technique, is the most extensive survey of partially seeing children and remains the only source of data relating to many educational and psychological characteristics of this group. Myers' and Kerby's studies form the nucleus of the material presented below, supplemented when possible by other findings.

Sex, Eye Conditions, and Visual Acuity

About half of the children in classes for the partially seeing surveyed by Kerby (1952) and Pintner (1942) had visual acuity within the range of 20/70 to 20/200, the range commonly used to define "partial sight." The majority of the remainder had milder defects, and only a few were legally blind. The percentage of boys enrolled in classes for partially seeing children increased from 50 percent in 1930 to 57 percent in 1952.

On the basis of evidence presented by Kerby and Pintner we may observe that (a) refractive errors account for about half of all visual defects among these children and (b) differences in diagnostic terminology and methods of reporting make exact description or comparison of data on the nature of eye defects very difficult.

Intelligence

Myers (1930) reported intelligence test data (tests unspecified) for 709 partially seeing children. He found 58.9 percent below IQ 90, 31.6 percent between 90 and 109, and 9.4 percent above 109. Pintner (1942) found Stanford-Binet IQs for 602 subjects, ages 10 to 12, to be distributed as follows: 41.4 percent below 90, 41.3 percent between 90 and 109, and 17.2 percent above 109. (A theoretical normal distribution would show 25 percent below 90, 50 percent between 90 and 109, and 25 percent above 109.) The mean IQ reported by Pintner was 95.1, the median was 93, and the range from 44 to 166. He found that enlarging the test materials did not significantly affect the IQs obtained by the partially seeing children.

Livingstone (1958) concurred with Pintner in finding no change on intelligence test scores with the enlargement of test items. He studied 60 subjects, ages eight and nine, whose visual acuities ranged from 20/70 to 20/200. He reported a mean IQ of 98.6. When he categorized 42 Binet subtests into 11 types of intellectual functioning, Livingstone found no significant differences between the performances of partially seeing children and normal children except that the partially seeing were lower on visual-motor coordination and higher on auditory memory, excluding digit repetition.

Mueller (1962) found that legally blind children (visual acuity 20/200 to 10/200) performed better on an enlarged version of the Peabody Picture Vocabulary Test than on the regular plates, but no such difference was found for partially seeing children (visual acuity 20/70 to 20/200). Mean IQs for the two groups on both forms of the test ranged from 88 to 92.

The available research indicates that partially seeing children tend to score slightly below seeing children on intelligence tests. However, there is no reason to assume an actual lowering of intelligence as a result of defective vision. More plausible explanations include: (a) the sample of children in classes for the partially seeing is biased due to the fact that when children of the same visual acuity differ in academic achievement and ability, those children with academic difficulties are more likely to be placed in a special class; and (b) the tests used might assess specific factors of visual perception, perceptual speed, or visual discrimination which would penalize the visually handicapped.

Educational Achievement

Peck (1933) administered an enlarged Stanford Achievement Reading Test, Form A, to 157 children in Cleveland sight-saving classes and found their reading to be at grade level.

Two studies (Eakin, Pratt, and McFarland, 1961; Nolan, 1959) found that partially seeing children read more slowly than normally seeing children—an observation frequently made by teachers of the partially seeing.

At the present time our information about the educational achievement of partially seeing children is grossly limited. The only study available on reading achievement (excluding speed) indicates no retardation in that area. Although there is some evidence (Peck, 1925; Myers, 1930) that the promotion rate for partially seeing children in special classes is not substantially different from that of normal children in the regular grades, this finding is difficult to interpret without knowledge of the standards used for special class promotion.

Personality and Social Adjustment

Attempts to assess the personality and social adjustment of partially seeing children encounter the difficulties inherent in measuring these traits—problems of definition, limitations in the use of paper-and-pencil tests, inadequate personality and adjustment theories, sampling procedure difficulties, and so forth—in addition to the problems of determining what norms are appropriate for this special group.

Several studies (Pintner and Forlano, 1943; Mull, 1948; Dennis, 1939; Hootman, 1935; Greenberg and Jordan, 1957) have used personality inventories to compare the responses of blind, partially seeing, and normally seeing subjects. The results have been inconclusive and have not established differences among the personality traits of these groups.

Two studies (Force, 1956; Murphy, 1960) have found negative social attitudes held by seeing subjects toward the visually handicapped in terms of desire to be with them socially or to work with them educationally.

Underberg's study (1958) of 40 seeing, 12 totally blind, 28 legally blind, and 31 partially seeing adolescents and their families reflects more current trends in personality evaluation dealing with complex, interrelated attitudes and interpersonal relations. Underberg states, "The partially sighted group might be characterized by somewhat greater child perception of pity and somewhat poorer parental understanding . . . [and] mothers of partially sighted, as opposed to the other mothers, perceive their children as being different from the average" (p. 73) . . . . "Partially sighted are relatively less able to accept their visual limitations than those whose handicaps are even more severe" (p. 67).

2 | Procedures

Definitions of terms, a description of the tests administered, the method of sample selection, and the procedures employed are presented in this chapter.

Definitions

A partially seeing child, for purposes of this study, is a child who is currently enrolled in a special class or resource program for partially seeing children which is recognized by the Illinois State Department of Public Instruction.

The state of Illinois (1952) requires that each child placed in a special program for the partially seeing receive individual consideration of his case and that it be established that he is not eligible for placement in a class for the mentally handicapped. Visual acuity should be between 20/70 and 20/200 in the better eye after correction, or four or more diopters of myopia be present. However, any child who, in the opinion of the eye specialist, would benefit from a program for the partially seeing is eligible for such placement. These criteria do not differ materially from those of Hathaway (1959) which are widely accepted.

Reading processes are operationally defined as performance on Monroe's Diagnostic Reading Examination (Monroe, 1930, 1932) which is described in a following section.

Psycholinguistic processes are operationally defined as performance on the Experimental Edition of the Illinois Test of Psycholinguistic Abilities (1961), referred to in the following sections as the ITPA.

Sample Selection

The Illinois State Department of Public Instruction records of classes for partially seeing children in Illinois in 1960-1961 were examined and all* programs meeting these two criteria were selected for testing:

1. The class was listed by the State Department as being organized on either a resource room or special class plan in an Illinois school district not within the city of Chicago.
2. The class contained children who were enrolled in any or all of grades one through four during the school year of 1960-1961.

Twenty such programs were thus selected, including more than 90

*One special class program was omitted because of extensive prior testing and research conducted within the school system.

percent of the partially seeing, grades one through four, in public school resource rooms or special class programs within the state, exclusive of the city of Chicago proper. The examiner tested all of the children enrolled, except eight who were not tested due to time limitations and absences. The total number of children tested was 131.

Tests Administered

The Revised Stanford-Binet Intelligence Scale, the Monroe reading test, Gates Speed and Accuracy Test (Gates, 1958c) and the Illinois Test of Psycholinguistic Abilities were administered to the subjects chosen for this study.

The Revised Stanford-Binet Intelligence Scale. Form L, was administered to all of the subjects for whom neither a Binet nor a WISC (Verbal) score obtained by a qualified psychological examiner was available, and to a few children whose available scores were questioned by their teachers. The total number of children to whom the Stanford-Binet was given by this examiner was 77, constituting almost 60 percent of the sample.

The Monroe Diagnostic Reading Examination measures both the quantitative and qualitative aspects of reading; that is, it assesses both level of achievement in oral reading, silent reading, word recognition, and word discrimination, as well as providing an analysis of the methods used in reading and the types of errors made.

The Gates Speed and Accuracy Test from the Gates Survey Test (1958c) consists of paragraphs of equal difficulty and requires that the subject read and answer one question about as many paragraphs as he can in a short time. Scoring is on the basis of number of paragraphs read and percentage answered correctly. This test was typed on a primary typewriter and mimeographed. The type size was thus approximately doubled, and the spacing between letters and lines of print substantially increased.

The Illinois Test of Psycholinguistic Abilities is a diagnostic test designed to provide a systematic means of examining the communication skills or psycholinguistic abilities of young children who may be severely handicapped in some aspects of language behavior.

Each of the nine subtests may be specified by each of three dimensions of language proposed in the theoretical structure of language: (a) channel of transmission (auditory-vocal or visual-motor); (b) process (encoding, decoding, or association); and (c) level (representational or automatic-sequential). See Kirk and McCarthy (1961) for further description and discussion.

Raw scores for each subtest are converted to standard scores based on

chronological age norms, and the standard scores are then plotted on a profile.

Methodology

Procedures for administration of tests and for the statistical analysis of data are presented in this section.

The Monroe reading test was administered to all third and fourth graders and to those second graders who in the judgment of the teacher and the examiner read well enough to score within the norms of this test. In addition to the Monroe test, the Speed and Accuracy Test of the Gates Reading Survey was given to the fourth graders in the last 18 classes visited and to eight third grade children who read well enough to score within the norms of the test.

TABLE 1

Tests Administered and Grade Level of Subjects

	ITPA only	*ITPA and Monroe*	*Monroe only*	*Total ITPA*	*Total Monroe*
Grade 1	18	0	0	18	0
Grade 2	15	17	0	32	17
Grade 3	1	40	0	41	40
Grade 4	0	2	37	2	39
Total	34	59	37	93	96

All testing was done by the author and standardized procedures, test materials, and time limits were used with all Binet, Monroe, and ITPA tests. The print of the Speed and Accuracy Test was enlarged. All testing was done individually with the exception of the speed and silent reading tests.

Information concerning the visual acuity and the eye condition of each subject was obtained from ocular reports sent to the schools each twelve months by ophthalmologists, optometrists, or general practitioners. For the most part, the most recent report available was used; however, there were cases in which different diagnoses of eye condition were given by various examiners and in these cases the majority opinion prevailed.

A small group of children showed obvious and severe difficulty in seeing printed material. These children placed material close to their faces, rotated pages, rubbed their eyes, frowned, moved to obtain different light, and so forth. This behavior, which was totally absent in the great majority of cases, was recorded in order that this group of severely handicapped children might be studied separately.

In cases where the sample was large enough and the distribution of scores approximately normal, the appropriate *t* test was employed to

test differences between groups after testing for homogeneity of variance by the *F* test. Many of the subgroups (for example, children with a particular eye condition) were too small to permit this type of analysis and in these cases non-parametric statistics were used, primarily χ^2 and the median test. Means, standard deviations, and profiles were used in descriptive analyses. Pearson correlations were obtained where appropriate.

3 | Subjects

Partially seeing children enrolled in grades one through four in twenty resource room and special class programs throughout the state of Illinois, excluding Chicago, were studied. With minor exceptions, the sample represented a complete population.

The sample is described below in terms of number, grade, sex, visual acuity, eye condition, IQ, class, and some relations between these variables. Although this description is peripheral to the main problems investigated, it is deemed desirable because such data have not previously been explored and it emphasizes the importance of specifying factors other than partial vision when generalizing about this group of children.

A total of 131 children were examined, distributed by sex and grade as shown in Table 2.

TABLE 2

Number, Sex, and Grade of Partially Seeing Children

Grade	*Girls*	*Boys*	*Total*
1	6	12	18
2	15	17	32
3	13	28	41
4	19	21	40 (39)
Total	53	78	131[a]
Percent	40.5%	59.5%	100%

[a] Reading and ITPA test scores were not obtained for one subject who was, however, included in data for visual acuity, eye condition, and so forth; therefore, the N sometimes appears as 130. The N also varies in other analyses of sub-groups as a result of unknown visual acuity, unclassifiable eye condition, and so forth.

The percentage of boys was 59.5, somewhat higher than that found by Myers (1930) and similar to Kerby's (1952) finding of 57.5 percent boys. The preponderance of boys may be the result of preferential placement practices, as will be discussed later.

The mean IQ for the total group (N=131) was 100.00. The mean IQ for the girls (N=53) was 97.5 compared to 101.7 for the boys. (t= 1.69; $p > .09$). Intelligence test scores for the total group were normally distributed.

Ocular reports were examined for all children, and where necessary, acuity notations were converted to approximate Snellen distance nota-

tion. Both near and far point acuities were noted where given, and in case of discrepancy between them, the near point acuity was used for classification. Six descriptive categories were used:

Very mild defect — Visual acuity better than 20/40 in the better eye after correction, or subject showed no detectable sign of visual difficulty.

Mild defect — Visual acuity from 20/40 to, but not including, 20/70 in the better eye after correction.

Moderate defect — Visual acuity from 20/70 through 20/200 in the better eye after correction.

Severe defect — Visual acuity less than 20/200 in the better eye after correction, but child did not show extreme signs of visual difficulty.

Very severe defect — Child showed behavioral symptoms of extreme difficulty in seeing as described earlier. (While placement in this category was subjective, it was believed to be highly reliable.)

Unknown defect — Visual acuity unknown, including cases recorded by eye specialist as unable to determine, incomplete ocular report, and changing acuity due to recent surgery.

These visual acuity ratings were distributed as shown in Table 3.

TABLE 3

Distribution of Visual Acuity Ratings

Visual Acuity Rating	*Description*	*Boys*	*Girls*	*Total*	*Percent*
1	Very mild defect	15	7	22	17.0
2	Mild defect	18	10	28	21.0
3	Moderate defect	28	16	44	34.0
4	Severe defect	4	7	11	8.5
5	Very severe defect	8	12	20	15.0
—	Unknown defect	5	1	6	4.5
		78	53	131	100.0

When these figures are compared to those of Kerby (1952) and Pintner (1942), we find very close agreement in the number of children enrolled in programs for partially seeing who have mild impairment, that is, visual acuity better than 20/70. Pintner and Kerby found fewer legally blind and more in the 20/70—20/200 range than were found in the present study. However, the methods of reporting are not the same, and some of the children classified as having a very severe defect (fifth category) in this study might fall into less handicapped ratings if

acuity scores were the only criterion used. The inclusion of a subjective criterion was preferred in this study in view of the lack of reliability of acuity ratings and as an attempt to group these youngsters in a way which made the relations between test scores and visual performance most meaningful.

Another reason for the occurrence of more severely handicapped in this study is that more than a third of the legally blind (visual acuity $<20/200$) children in this study are blind due to retrolental fibroplasia, the full impact of which was not yet seen in school age children at the time of the earlier studies (Kerby, 1952; Myers, 1930).

Scientific advances and improvement of optical aids now allow some children to function as partially seeing who a few years ago would have been educationally blind, thus further increasing the proportion of legally blind in classes for the partially seeing.

It is interesting to note that of the 22 children falling into the very mild defect category, that is, having visual acuity better than 20/40 or showing no sign of visual difficulty, 12 children were in two classes. None of the other 18 classes had more than two children in this category. The class average visual acuity ratings (assigning the numerical values 1 to 5 to the acuity ratings from very mild to very severe, and eliminating those children with unknown acuities) ranged from 1.3 to 4.4, suggesting that admission practices vary from class to class.

In further analyses of visual acuity, the first and second categories were combined as "mild defects," the third category remained "moderate defects," the fourth and fifth were combined as "severe defects," and the sixth (six children) was eliminated.

Sex and Visual Acuity

The girls in this sample were more severely handicapped than the boys. It was found that 33 percent of the girls' visual defects were mild, 31 percent moderate, and 37 percent severe, compared to the boys' ratings of 45 percent mild, 38 percent moderate, and 17 percent severe ($\chi^2 = 6.36$; 2 *df*; $.05 > p > .02$).

Eye Conditions

An attempt was made to classify subjects by type of eye condition. Any classification system of this sort is inadequate due to the multiplicity of defects often, or usually, occurring simultaneously and the difficulty inherent in determining the relative importance of each condition. Differences in diagnostic terminology used by the optometrist, ophthalmologist, or general practitioner in filling out the ocular reports further complicate classification, as do changing eye conditions and late developing secondary complications. In about 10 percent of the cases,

reports were available from several different eye specialists, each of whom had recorded different diagnoses. However, an attempt was made by the examiner to classify each child's eye condition as accurately as possible. The distribution of conditions was found as shown in Table 4.

TABLE 4

Frequency and Percentage of Eye Conditions

Condition	*Number of Cases*	*Percent*
Albinism (including albinism with nystagmus)	7	5%
Cataracts (including bilateral, unilateral, congenital and aphakia)	20	15%
Myopia (including progressive, degenerative and myopic astigmatism)	32	24%
Myopia with strabismus, esotropia, or nystagmus	7	5%
Hyperopia (including hyperopic astigmatism, and with strabismus, nystagmus, or esotropia)	10	8%
Retrolental fibroplasia	17	13%
Esotropia (including esotropia with nystagmus, and including amblyopia ex anopsia)	11	9%
Nystagmus	10	8%
Other (optic atrophy, glaucoma, choreoretinitis, etc.)	17	13%
Total	131	100%

Refractive errors (myopia, hyperopia) accounted for 37 percent of all cases; muscle deviations (esotropia, nystagmus) for 17 percent; retrolental fibroplasia, 13 percent; cataracts, 15 percent; and all others 18 percent. Among the 17 cases not classified above ("other") were two

TABLE 5

Eye Condition and Visual Acuity, Grade, CA, and IQ

Eye Condition	*N*	*Average Visual Acuity**	*Average Grade*	*Average CA months*	*IQ* *Mean*	*SD*
Albinism	7	2.43	2.14	94.1	98.45	12.15
Cataracts	20	2.60	2.80	105.0	104.75	17.95
Myopia	32	2.25	3.10	111.2	94.20	14.15
Hyperopia	10	1.40	3.20	110.5	96.50	17.25
Retrolental Fibroplasia	17	3.94	2.70	102.0	106.80	13.15
Esotropia	11	2.45	2.36	98.4	98.35	15.20
Nystagmus	10	2.80	2.60	100.0	103.00	11.75
Myopia and Muscle Deviations	7	3.14	2.86	103.5	99.15	22.15
Other conditions	17	3.18	2.65	102.6	98.45	16.55

*The numerical values 1-5 were assigned to the five categories of visual defect in increasing order of severity.

cases of astigmatism; four, optic atrophy; two, glaucoma; four, retinal fold, agenesis, or degeneration; two, choreoretinitis; one, amaurosis; one, cataract with albinism and nystagmus; and one, cataract with glaucoma and buphthalmos.

Table 5 shows that the myopes and hyperopes were older, less severely visually handicapped, and scored less well on the intelligence test than did the other groups.

The relation between the visual acuity and eye conditions of the 125 subjects for whom these data were available is shown in Table 6.

TABLE 6

Visual Acuity and Subjects' Eye Condition

	Visual Acuity			
Eye Condition	*Mild Defect*	*Moderate Defect*	*Severe Defect*	*Total*
Albinism	1	5	0	6
Cataracts	6	5	6	17
Myopia	17	17	4	38
Hyperopia	10	0	0	10
Retrolental Fibroplasia	3	3	11	17
Muscle Deviations	8	8	4	20
Other	5	6	6	17
Total	50	44	31	125

As a group, children with refractive errors were less severely visually handicapped in terms of visual acuity, than were those with albinism, cataracts, retrolental fibroplasia, or muscle deviations. The visual defect distribution for children with refractive errors was 56 percent mild, 35 percent moderate, and 8 percent severe, compared to 30 percent mild, 35 percent moderate, and 35 percent severe for those with non-refractive eye conditions ($\chi^2 = 12.37$; 2 *df*; $p < .01$).

TABLE 7

Visual Acuity and IQ

Degree of Visual Defect	*Mean IQ*	*N*
Mild	95.0	50
Moderate	101.1	44
Severe	106.1	31
Total		125

$F = 4.67$; $p < .01$

Visual Acuity and IQ

A statistically significant trend was found for the more severely visually handicapped in the classes studied to score higher on the intelligence test than did the mildly handicapped, as shown in Table 7.

Discussion

One might speculate that although males perhaps actually do have a slightly higher incidence of eye defects than do females, consistent with their higher prevalence of certain birth defects and susceptibility to some diseases, the ratio of almost three boys to two girls found in this study and Kerby's reflects preferential placement practices in special programs. This possibility is supported by data showing that the boys have less severe visual problems than do the girls, and also by the fact that the boys' average IQ exceeds the girls' by four points. Further speculation might suggest that thirty years ago, when Myers found the ratio of boys to girls to be one to one, admission to programs for partially seeing children was based more exclusively on eye condition and visual acuity than it is today. It may be that current admissions are also based in part on the difficulty a child has in the regular room. It is known that boys are more subject to academic difficulties and to classroom behavior problems than are girls; hence, the predominance of boys might be predicted.

While variation in admission policies among the classes was observed, an even more subjectively noticeable tendency was that many of the children appeared to fall into one of two large groups which might be described as follows: (a) children with very severe visual handicaps, above average intelligence, and eye conditions other than and more complex than simple refractive errors, who were achieving well in school in spite of their severe visual limitations, and (b) children with relatively minor visual problems (predominantly refractive), who were either low achievers or below average in intelligence, or both.

4 | Results: Reading

Reading Achievement

The reading level or achievement of partially seeing children was examined and is discussed in this section in relation to grade level, chronological age, mental age, IQ, and sex. Speed and accuracy of reading of a small group of children is also discussed.

Although an exact determination of reading expectancy is impossible, the single criterion factor most widely used is mental age. Harris (1956), however, suggests that reading achievement should be at least six months below mental age before it is to be considered a discrepancy. Monroe (1932) has broadened the base for estimating appropriate reading level by including chronological age, grade placement, and arithmetic level in addition to mental age in a single index. Olson (1949) estimates reading expectancy in terms of total "organismic age," which takes into account the patterns of growth in height, weight, dentition, grip strength, ossification of wrist bones, mental age, and general school achievement.

Perhaps additional factors are relevant to the evaluation of reading expectancy and reading achievement of partially seeing children. The possibility exists of devising an index which would take into account years spent in school, age at diagnosis of visual problem, changed eye condition, or other factors which might correlate with reading of partially seeing children, but this is beyond the scope of this study. Here, actual reading level will be described and then compared with two factors—mental age and grade placement. The assumption is made that grade placement will have been largely determined by consideration of these special factors which are relevant to the reading expectancies of individual partially seeing children.

The primary question to be considered here is how well these children read in comparison with normally seeing children. Throughout the discussion the comparison group of normals is the group upon which the particular test norms were based. The assumption is made that there is no reason to believe that the sample used in this study differs from the test standardization groups in any ways other than those related to their visual problems.

Reading Achievement and Grade Level

Gray's Standardized Oral Reading Paragraphs (1916), the Iota Test of Word Recognition (Monroe, 1932), the Monroe Word Discrimination

Test (1932), and Gates Primary or Advanced Primary Reading Test, Paragraph Type (1958) were administered to 39 fourth graders, 40 third graders, and 17 second graders. The average reading grade is the mean of the grade level scores (obtained from the test norms) on these four tests.

Averaging reading grade scores obtained on four different tests was done here in order to utilize Monroe's error type standard scores which were so derived. Also, the scores obtained by this sample did not reveal large discrepancies among the four tests.

The tests most comparable to those widely given in school systems to determine reading level are the Gates reading tests (silent), and it should be noted (Table 8) that the third and fourth grade children scored higher on these tests than on the others. In terms of this measure of reading achievement, the partially seeing fourth graders were two months below grade placement and the third graders were one and one-third months above grade placement.

TABLE 8

Reading Achievement of Partially Seeing Subjects on Four Reading Tests by Grade Level

	Fourth Grade $N = 39$	*Third Grade* $N = 40$	*Second Grade** $N = 17$
Gray's Oral Reading	3.63	3.09	2.25
Gates' Silent Reading	3.98	3.33	2.76
Iota Word Recognition	3.75	3.20	2.54
Monroe Word Discrimination	3.87	3.20	2.92
Average Reading Grade	3.85	3.22	2.59
Actual Average Grade Placement	4.2	3.2	2.2

*The second graders were selected as the best readers and those not able to score above norms were excluded; thus, this group is not representative of second graders, and is not included in further analyses of reading achievement, except as noted.

It may be seen in Table 8 that the average reading grade of the children in the third grade is the same as their average grade placement. The fourth graders read an average of .35 school year (3.5 school months) below their placement. The second graders were those believed to be able to read within the test norms (17 out of 32) and were not representative of the total second grade group. All three grades scored least well on oral reading, a finding which may be due in part to outdated norms (if there has in fact been a decreased emphasis on oral reading in recent years) and in part to the inclusion of a small speed factor in the scoring of oral reading. The third and fourth grades scored highest on the silent reading comprehension test, which was administered with

strict adherence to the standard time limits. (The general practice in special classes is to allow time-and-a-half for partially seeing children on achievment tests.)

Deviation of Reading Age from Mental Age

The average reading grades were converted to reading ages by use of Gates' (1958 b) tables based on empirical rather than theoretical relations between chronological age and grade placement. The mean deviation of reading age from mental age was —5.2 months for the third graders (N=40) and —6.5 months for the fourth graders (N=38). Three out of five of these children were not reading up to their mental ages.

An interesting relationship between intelligence and the discrepancy between mental and reading ages was suggested by the fact that the average IQ of the eleven children reading more than 24 months below their mental ages was 115.4, whereas the average IQ of those six reading more than 15 months above their mental ages was 85.1, a difference of more than 30 points. The correlation between IQ and the magnitude of the discrepancy between mental age and reading age was .498; that is, there was a significant tendency for the brighter children to read less well in relation to their mental ages than did the slower children. Several factors may enter into this relationship: (a) mental age theoretically imposes a ceiling on reading age, but does not impose a lower limit, thus making it impossible for reading age to greatly exceed mental age, but in no way affecting the reverse situation; (b) teaching methods may be primarily geared to bringing the slow child up in reading rather than to further advancing the bright child; (c) more of the variance in IQ scores *is not* related to educational achievement than *is* related to it; and (d) of the four reading tests used (equally weighted) in the determination of average reading grade, only one measures comprehension, which is more highly related to mental age than are the other three types of reading measured.

Deviation of Reading Achievement from Grade Placement

The discrepancy between average reading grade and actual grade placement was computed for each subject. Grade placement was used in the evaluation of reading achievement because it is the commonly used index. The question of how well children are reading is most frequently answered in relation to their grade placement. The performance of the partially seeing group appears more "normal" when compared to grade placement than when compared to mental age. This is to be expected since grade placement is partially determined in many cases on the basis of reading achievement.

Average discrepancies between grade placement and average reading grade were computed for each of the twenty classes tested. The average discrepancy was between +2 and −9 months for twelve classes; below −10 months for two classes; and between +3 and +12 months for five classes. (One class had no children who scored within reading norms.) The class with the highest average deviation, +11.8 months above grade placement, was the class with the most severely visually handicapped pupils (average visual acuity rating of 4.4, assigning numerical values 1-5 to the categories of visual defect listed earlier), although a rank order correlation between average severity of visual acuity and average reading deviation for each class was not significant ($r = +.32$).

The correlation between IQ and positive deviation of reading grade from grade placement was .46, that is, the higher the IQ, the higher the reading grade in relation to grade placement. This finding, plus the fact that the high IQ children did not read as well as the low IQ children when mental age was used as the single criterion for evaluating reading level, again strongly suggests that, for the reasons given earlier, mental age alone is not an adequate predictor of the reading performance of these children.

Reading Achievement and Sex

The average reading grade for the boys (N=57) was 3.37, compared to 3.36 for the girls (N=39). Excluding second graders, the average deviation of reading age from mental age was −2.76 months for the girls (N=29), and −7.63 months for the boys (N=49), a difference which is not significant ($t = .17$). Although the boys' average IQ and mental age are slightly higher than the girls' (based on the total group), there was no difference in level of reading achievement.

Speed and Accuracy of Reading

Since slowness in reading is often said to be a major problem among partially seeing children, a peripheral investigation was carried out, using 46 subjects, to examine the validity of this assertion.

An enlarged form of Gates Survey Speed and Accuracy Test was administered to 34 fourth graders and to 12 third graders. The average reading speed of the fourth graders was at the 3.58 grade level, two months below their average reading achievement and six months below their grade placement. The average reading speed of the third graders was 2.98, compared to their average reading grade of 3.22. Only one subject showed a retardation in speed of reading greater than a year and a half below his average reading grade. Although, as a group, these partially seeing children did score slightly lower on speed of reading than on other aspects of reading, there was no support for the contention

that they have a serious problem in this area of reading achievement. A more precise analysis is precluded because the comparability of the speed test norms with the other norms is unknown. The effect of the size and style of print used in the enlarged test is also unknown, but may have been considerable.

Accuracy ratings for performance on the speed and accuracy test based on the percentage of items correct among those attempted and on reading level as determined by the total number of items correct were obtained from the test manual of Gates Survey Test (1958c). Ratings on a five point scale range from very low to very high accuracy. In the standardization group one-fifth of the population fell in each of the five categories. Accuracy ratings for the 46 third and fourth graders tested were: 6 very low; 7 low; 10 medium; 6 high; 17 very high. Chi square, based on an expected frequency of 9.2 subjects for each rating, revealed higher accuracy than average on the part of these partially seeing children ($\chi^2 = 9.52$; $4df$; $.05 > p > .02$).

The small sample and the unknown effect of using unstandardized test materials prevent definitive generalizations about the speed and accuracy of reading among partially seeing children.

The results presented above, based on what is believed to be a representative sample of partially seeing children, show that in general the reading achievement of these children does not differ from that of normally seeing children.

Reading Processes

The kinds of reading errors made by partially seeing children are analyzed and discussed in this section. The group error profile for the partially seeing is compared to error profiles for two normally seeing groups.

Reading Errors

Monroe's Diagnostic Reading Examination (1932) includes a test of oral reading, word recognition, silent reading, and word discrimination. The grade level scores for each of these are averaged to obtain the average reading grade. Every error made in oral reading, word recognition, and word discrimination is analyzed according to type of error—vowel, consonant, reversal, addition of sound, omission of sound, substitution, repetition, addition of word, omission of word, or word refused or aided. If, for example, the word "pen" were misread as "bind," analysis would reveal a reversal, vowel, and addition of sound error. Each error type is totaled and this total converted to a proportionate score based on a unit of 500 words read. (This is necessary because not all children read the same number of paragraphs on the oral reading test. A child who reads

twelve paragraphs would be expected to make more total errors than the child who reads only two paragraphs.) The corrected (proportionate) error score for each type is then converted to a standard score according to average reading grade. Thus, children who read at a second grade level are compared with others at the same reading level, regardless of grade in school, mental age, and so forth.

The profile of reading errors made by 96 partially seeing children, grades two through four, is presented in Figure 1 (solid line). These scores are plotted in standard score units derived from Monroe's standardization group. The hatched band indicates (only approximately) the area in which the partially seeing group's standard scores are not significantly different from the standardization group.

These Monroe error type norms were based on 101 children drawn in 1930 from two Chicago schools, both of which were in relatively high-status occupational districts (milling, industrial, and foreign population districts were excluded). The general applicability of such norms was perhaps questionable in 1930, and probably doubtful now in view of changed teaching methods in reading, possible changes in educational standards, and changes in population composition.

The question may be raised as to why the Monroe test was chosen as the tool for the analysis of reading processes. The primary reason was that it is the only instrument currently available for the proposed analysis.

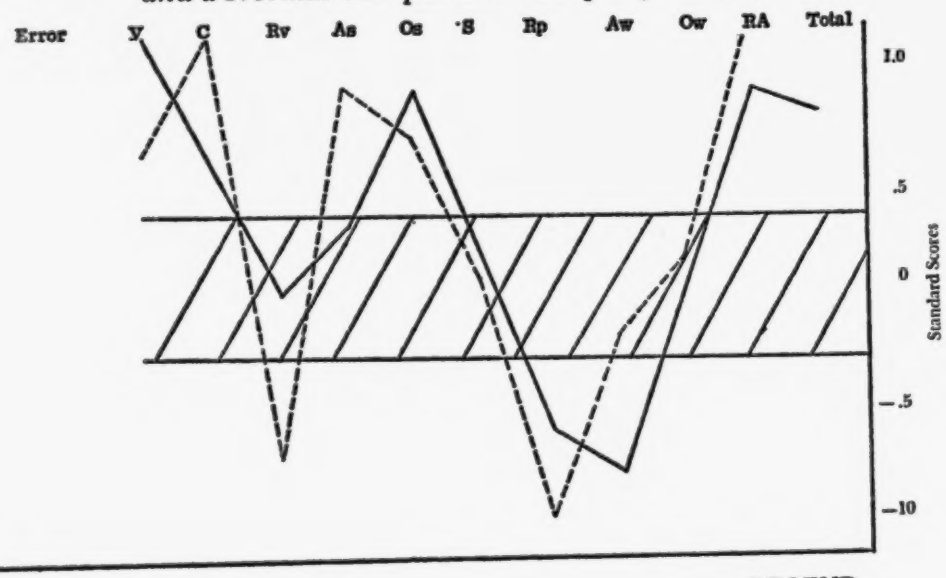
Also, although the apparent defects in the norms might have been suspected from an evaluation of the sample on which they were obtained, no previous study had suggested that they were in fact no longer applicable. Had a control group been used in this study, as would have been desirable for comparison with the partially seeing children, the same problem of interpretation of the control group scores in relation to the standardization norms would have obtained.

In the absence of a control group within this study, a comparison group of normally seeing children included in Dunn's (1954) study is also presented in Figure 1 (dotted line). This comparison group consists of 30 boys with mental ages from 8-0 to 10-0, IQs from 95 to 112, and an average reading grade placement of 3.16. It was hoped that the use of this comparison group in addition to the standardization group would make the interpretation of the partially seeing group's error profile more meaningful.

Table 9 presents error type means, standard scores, standard deviations, and statistical comparisons for the partially seeing group, Dunn's comparison group, and Monroe's standardization group. It may be seen that: (a) in relation to the standardization group, partially see-

FIGURE 1

Error Profiles of Partially Seeing Children ($N = 96$) and a Normal Comparison Group ($N = 30$)*



* Data from Dunn (1954, p. 50)

LEGEND
Partially Seeing ———
Normal - - - - - - - - - - -

ing children made *more* vowel, consonant, sound omission, words aided and refused, and total errors, while they made *fewer* errors in addition of words and repetitions and *did not differ* in number of reversals, additions of sounds, substitutions of words, or omissions of words; and (b) in relation to Dunn's normal comparison group, the partially seeing made *fewer* consonant and addition of sound errors, and *more* reversal errors.

The only error in which the partially seeing children differed from both "normal" groups was consonants, where the partially seeing children fell between the two "normal" groups.

If the assumption that Dunn's comparison group is a more appropriate reference group than the original standardization group is justified, one could conclude that the partially seeing make more reversals than normals, and either do not differ or make fewer errors of all other types.

The following analyses of specific errors are based on the error type profiles presented by the partially seeing group, the comparison group from Dunn's study, and the Monroe standardization group.

Faulty vowels. It may be seen from Table 9 that the partially seeing children made more vowel errors than did either Monroe's standardization group or Dunn's comparison group. The partially seeing group

made more vowel errors than any other type error—vowels being the only error type for which the group mean standard score exceeded +1.0. Regardless of the exact level of statistical significance involved, it appears that the vowel errors did constitute the most troublesome area for these partially seeing children. Monroe (1932) has suggested that reasons for vowel errors include faulty discrimination of speech sounds, speech defects, inability to associate visual and auditory symbols, and confusion with temporal sequence of sounds. Another factor which seems especially relevant for the partially seeing is the fact that all five vowels are the same height and that all except "i" are quite similar in shape. One might presume that they are therefore more difficult to discriminate visually. However, the group of children classed as having mild visual defects made more vowel errors than did either the moderately or severely handicapped groups, as is shown later.

TABLE 9

The Reading Errors of Partially Seeing, Comparison, and Standardization Groups

	N = 96 *Partially Seeing*		N = 30[a] *Comparison*		N = 101[b] *Standardization*		*P.S. and Comp. Group*	*P.S. and Stand. Group*
Type of Error	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*t*	*t*
Faulty Vowels	+ 1.11	1.25	+ .63	1.22	.00	.98	1.87	6.88*
Faulty Consonants	+ .50	1.24	+ 1.15	1.59	+ .02	1.00	2.06	2.98*
Reversals	− .01	1.25	− .73	0.63	− .02	.98	4.20*	.06
Addition of Sounds	+ .29	1.13	+ .91	1.25	− .01	1.03	2.44	1.97
Omission of Sounds	+ .89	1.51	+ .68	1.38	+ .02	1.04	.72	4.77*
Substitution of Words	+ .19	1.24	+ .03	0.98	− .01	1.03	.73	.81
Repetitions	− .63	1.43	− 1.00	1.04	+ .02	.98	1.13	3.71*
Addition of Words	− .81	.77	− .20	1.93	− .01	1.01	1.69	6.30*
Omission of Words	+ .12	1.52	+ .16	1.58	.00	1.04	.13	.65
Words Aided and Refused	+ .89	1.42	+ 1.19	1.09	− .01	1.02	1.22	5.10*
Total Errors	+ .98	1.23	not reported		.00	.98		4.91*

[a] Dunn (1954, p. 50)
[b] Monroe (1932, p. 58)
*$t = 2.616$. $p = .01$ (either column).

Dunn (1954) found that mentally retarded boys made significantly more vowel errors than did his normal controls. In view of this finding and the fact that the mildly visually handicapped children in this study constituted both the least intelligent group and the group most prone to make vowel errors, it appears plausible that excessive vowel errors

may be related to relatively low mental ability. This deficit, in addition to those factors mentioned by Monroe, presumably would delay accurate learning of the phonic rules involved in properly sounding vowels.

Faulty consonants. As can be seen in Figure 1 and Table 9, the partially seeing children made more consonant errors than did the standardization group, but fewer than Dunn's comparison group. The mean consonant error score for the partially seeing fell midway between the other two groups. It appeared to the examiner that the bulk of the consonant errors fell into two categories: (a) those made by children at the lowest average reading grade levels, that is, those who were just learning to read and achieved an average reading grade minimally within norms by virtue of their sight vocabularies and in spite of their almost total absence of phonic understanding; and (b) those made by the children with high average reading grades while reading totally unfamiliar words in the seventh and eighth grade-level paragraphs of the oral reading test. Many of these words contained consonants with irregular or unfamiliar sounds; for example, the "ch" in character.

Since most of the consonant errors seemed to be of these types and since the errors were fewer than those made by the normal comparison group, it is not believed that consonant errors constitute a particular difficulty for these partially seeing children, in spite of the fact that they did exceed the consonant errors of the standardization group.

Reversals. The reversal error score of the partially seeing children was higher than that of the Dunn comparison group but did not differ from the Monroe standardization group. If the comparison group's reading is taken as representative of the reading of normal children today, it appears that partially seeing children do make more reversal errors than do normal children. One of the factors which might partially account for this is the difficulty with directional eye movements found in particular eye conditions, such as nystagmus.

Other errors. The partially seeing children did not make excessive sound addition, substitution, repetition, added word, or omitted word errors. The interpretation of low error type scores is questionable; some reading experts argue that if a child makes few errors of a given type, no significance may be attached to this finding. Nonetheless, it may be noted that the partially seeing children made fewer additions of sounds and words than did the comparison group, and made more omissions. This might suggest a tendency for children with visual defects to fail to perceive all that is printed rather than to misperceive it.

Discussion

The differences between the profiles of the standardization group and the only other "normal" group available for comparison render the

interpretation of the error profile of the partially seeing group somewhat unclear. However, it appears that due to the similarities in the profiles of the partially seeing and Dunn comparison groups, whose combined N was a third greater than that of the standardization group, probably both of these groups more accurately represent typical current reading processes in school children than does the standardization group.

If the partially seeing children actually made excessive errors of any type, it appeared to be vowel errors, for reasons discussed previously.

Reading and Visual Defect

Level of reading achievement and error types were examined in relation to both visual acuity and eye condition.

Table 10 shows a trend for those children with mild visual defects to read less well in relation to grade placement than did those with more severe visual deficits.

TABLE 10

Visual Acuity and Reading Achievement

Degree of Visual Defect	*Mean Grade Placement*	*Mean Reading Grade*	*Difference*
Mild	3.53	3.22	−.31
Moderate	3.42	3.58	+.16
Severe	3.25	3.39	+.14

Reading Achievement and Eye Conditions

The children were grouped by eye condition (refractive or non-refractive defect) and the reading achievement of the two groups compared. The non-refractive group read better in relation to grade placement in all areas than did the refractive group, the greatest superiority being on the Iota Word Recognition Test. This may be partially explained by the fact that the refractive group tended to have lower IQs and to be made up of children with mild visual defects who may have been placed in the class because of reading difficulties.

When median scores (above or below the median deviation of average reading grade from grade placement) were placed in a contingency table, the relation between eye condition and reading achievement was significant, as shown in Table 11.

The clustering of mild visual defect, refractive errors, lower intelligence, and lower reading achievement strongly suggests again that these children were placed in classes for the partially seeing for reasons beyond visual defect per se.

Accuracy ratings obtained on the speed of reading test clearly differ-

TABLE 11

Reading Deviation from Grade Placement and Eye Condition

	Refractive	*Non-refractive*	*Total*
Above Median	13	27	40
Below Median	22	17	39
Total	35	44	79

$\chi^2 = 3.84$; 1 *df*; $.05 > p > .02$
Yates correction applied.

entiate the two groups. The refractive group (N=20) had a mean accuracy rating of 3.0 (medium accuracy), while the non-refractive group (N=26) had a 4.0 (high accuracy) rating.

Error Types and Visual Acuity

The relation between error type and degree of visual defect was examined. Although none of the differences between groups approached statistical significance, those with mild defects tended to make more errors of all types except words aided and refused. This is consistent with their tendency to perform less well in reading achievement, and it is to be expected that many of the poorer readers had established patterns of guessing at unknown words.

Error Types and Eye Conditions

When the error profiles of children with refractive defects (N=42) were compared to those of children with non-refractive defects (N=54), no differences were found. The error profiles for each specific type of eye condition were based on small samples and are not presented here. The small number of cases in each profile prevented analysis in terms of significant differences, but a few points do appear noteworthy. Those subjects with refractive defects and nystagmus most nearly parallel the profile for the entire group presented earlier (Figure 1), with vowel and sound omission errors having the highest frequencies.

The profile most similar to that of the test standardization group, that is, most nearly flat, is the one representing children with cataracts. If the sample were larger and the same finding obtained, one might hypothesize that this finding results from the fact that many of the cataracts were unilateral; hence, only one eye was used in reading. This, in turn, reduces the likelihood of poor fusion or muscular imbalance, both of which have been suggested to influence reading.

The children with retrolental fibroplasia show the highest frequency of words aided and refused and are also the group with the highest average IQ. Perhaps this group was especially reluctant to guess at unknown words.

5 Results: The Illinois Test of Psycholinguistic Abilities

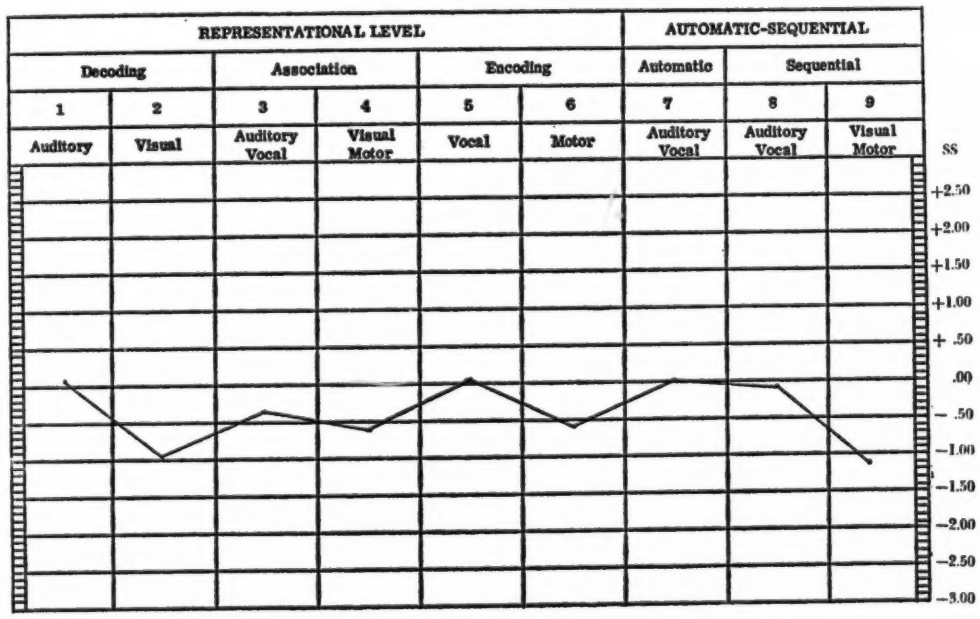
The ITPA was administered to 93 partially seeing children, grades one to three, to determine how their performance on this test differed from that of normally seeing children. The standardization group upon which the ITPA norms were established (N=700) was presumed to represent a normal group. The following analyses were made on the standard scores obtained by the partially seeing children from the ITPA chronological age norms.

Psycholinguistic Subtest Scores

The group mean standard scores of the partially seeing children on the nine subtests of the ITPA are presented in profile form in Figure 2.

FIGURE 2

Group ITPA Profile



Total Group (N = 93)

Table 12 presents the mean standard scores for the partially seeing group based on the chronological age norms, the standard deviations, and *t*'s, based on the comparison of the partially seeing group with the

standardization group. Mean standard scores for the partially seeing children based on their mental ages (in parentheses) are also presented.

TABLE 12

Comparison of ITPA Standard Scores of Partially Seeing Children (N=93) and Test Standardization Group (N=700)

Subtest	*Mean*		*Standard Deviation*	*t*
	CA	*(MA)*		
Auditory-Vocal Automatic	+ .01	(+ .08)	1.00	.096
Visual Decoding	− .945	(− .94)	1.18	7.68**
Motor Encoding	− .695	(− .66)	1.03	6.50**
Auditory-Vocal Association	− .275	(− .22)	1.07	2.48*
Visual-Motor Sequential	−1.095	(−1.06)	.96	10.95**
Vocal Encoding	+ .05	(+ .07)	.95	.51
Auditory-Vocal Sequential	− .11	(− .06)	1.19	.89
Visual-Motor Association	− .640	(− .60)	1.07	5.76**
Auditory Decoding	+ .10	(+ .10)	1.10	.88
Total Language Age	− .740	(− .685)	1.19	5.96**

*$t = 1.987$; 92 *df*; $p = .05$
**$t = 2.631$; 92 *df*; $p = .01$

The presentation of mental age scores was considered desirable because of the difference in mean IQs between the standardization group (mean IQ = 103.6, ages 7-9) and the partially seeing group. Since this difference is not statistically significant, an analysis of covariance was not necessary. On each subtest the mean MA score is either not different from the mean CA score or is raised slightly (due to the fact that the standardization group mean IQ was higher than that of the partially seeing children in this study).

Auditory decoding subtest. The partially seeing children scored as did the normals on this measure of deriving meaning from the spoken word. In view of the fact that an emphasis on oral work and listening activities is often advocated in special programs for these children, it might be expected that they would be superior to other children in auditory decoding. The fact that they do not differ might suggest that they had not actually received extra training in this area, that the process as measured by this subtest is not readily influenced by extra experience, or that the subjects' presumed lack of visual familiarity with some of the objects named in the test is simply compensated by an actual superiority in auditory decoding.

Visual decoding subtest. The mean standard score for the partially seeing group was almost a standard deviation below the normals, showing a clear and significant deficit in obtaining meaning from visual

symbols (pictures). This deficit could be the result of either or both of two factors: (a) the children lacked a background of visual experience with the objects pictured, or (b) they were unable to perceive the pictures of the objects clearly. An examination of picture clarity and of the items frequently missed suggests that in most cases the children either were unfamiliar with the objects, or the pictures showed otherwise familiar objects from an unfamiliar perspective. Items frequently missed included a boat seen from a bird's eye view, a partially opened jackknife, a hack-saw, an air pump, and a hydraulic jack. The examiner queried several children after the test concerning certain pictures, and their responses indicated a lack of familiarity with the objects presented rather than an inability to see the pictures. All children knew they were free to use a magnifying glass or a projector if necessary, but none so requested. The subjects did not appear to need additional viewing time, or to feel it would have helped them.

Auditory-vocal association subtest. The mean standard score in this verbal analogies test was —.275. Although this finding was statistically significant ($p < .05$), further study is necessary in order to offer a reasonable explanation in the event that the difference is other than statistical. When the mean standard score of —.22, based on mental age, was used, the difference was not statistically significant ($p > .05$).

Visual-motor association subtest. The partially seeing children were significantly below the normals on this measure of the ability to make associations between visual stimuli. Visual discrimination of pictures in this subtest appeared to present some problems for many of the partially seeing group. For example, many of them pointed to the paper clip rather than the safety pin as the object associated with the baby, and many of them indicated that a cigarette went with a horse, thinking the former to be a bale of hay, as revealed in subsequent questioning. Another factor which may have influenced the group score was that the "majority" response from the standardization group was designated the "correct" response. In a sense, then, this subtest is a measure of *conformity* rather than *logicality* of association. Many children, for example, indicated that book, rather than table, went with lamp—a response which seems quite correct for this group, and yet was necessarily scored as incorrect.

Vocal encoding subtest. On this test of verbal expression the partially seeing children did not differ from the standardization group. Some superiority in this test might have been expected, as was discussed previously under auditory decoding, but it either did not exist or was not evident for the reasons given earlier.

Motor encoding subtest. The mean group standard score on this measure of motoric expression of ideas was significantly below normal.

This subtest, more than any other in the visual-motor channel, appears to pinpoint the nature of the visual channel deficit shown by this group of partially seeing children. Since standardized procedure allowed the examiner to name the object whose use was to be demonstrated by the subject (if he hesitated to respond or requested the name) the problem of visual perception or visual discrimination of test materials was eliminated. The deficit in this area thus points to a lack of knowledge of the objects' use—knowledge which is usually gained by visual experience. This may be illustrated by the fact that, as a group, these children were unable to demonstrate the playing of a trombone. Although few normally seeing children of this age have actually played the instrument, they have seen it played and have seen it clearly enough to recognize the instrument and to reproduce the gestures involved. The partially seeing children were unable to do this even though the instrument was named for them. An interesting observation on this subtest was that the children who misperceived the hand drill as being an egg beater (as revealed in later questioning) and so demonstrated it, scored higher than did those who hesitated or asked what it was and were told it was a "drill." A further sidelight was that almost 100 percent of the partially seeing children successfully demonstrated the binoculars, perhaps suggesting that parents had made a special effort to expose these children to this device.

Auditory-vocal automatic subtest. The partially seeing children scored no differently than normals on this grammar subtest, as would be expected.

Auditory-vocal sequential subtest. The partially seeing children did not differ from normals on the auditory-vocal sequential subtest, showing no "compensative superiority" in immediate auditory sequential memory. This finding is similar to that obtained with the blind, notwithstanding the popular misconception to the contrary. Livingstone (1958), as mentioned earlier, also found no difference between partially seeing children and normals on digit memory on the Binet.

Visual-motor sequential subtest. The partially seeing children's greatest deficit was found in the area of sequential memory for visual symbols. The nature of the test material (single line geometric figures about an inch in height) decreased the possibility that this deficit was due to difficulty in visual discrimination per se. It appeared to the examiner that the children needed more than the five second viewing time alloted by standard procedure. Limited eye span, which is even further limited by the necessity of viewing the material from a distance of only a few centimeters in many cases, seemed to prevent the children from viewing the entire sequence of designs, particularly when four or more designs were presented.

Since this is a memory task, parallel to digit repetition, designing a procedure to test the effect of increasing the "viewing span" without confounding the "memory span" by the introduction of a learning period would be challenging.

Psycholinguistic Processes, IQ, Grade, Visual Acuity, and Eye Conditions

The ITPA profiles were examined in relation to IQ, grade, visual acuity, and eye conditions. Profiles drawn for those partially seeing children with IQs above 114 (N=18) and those with IQs below 84 (N=14) paralleled each other almost exactly except that the low IQ group showed a greater deficit in the auditory-vocal association area than would be expected from the rest of the profile. It may be that the total group (N=93) mean standard score of −.275 on auditory-vocal association was reflecting a disproportionate lowering by the lowest IQ members.

No relationship was found between grade level and performance on the ITPA. The possibility exists that if classes for the partially seeing were successful in teaching these children to increase their visual channel efficiency or effectiveness, the result of longer classroom experiences would be seen as decreased deficits in this channel. However, these decreases were not found.

Figure 3 presents the ITPA profiles for subjects with (a) mild visual defects (N=33), (b) moderate defects (N=31), and (c) severe defects (N=24).

The relative elevations in the profiles (disregarding the marked visual channel deficit of the severe defect group) are apparently a function of the differences in intelligence between the three groups. The mild and moderate defect profiles parallel each other on all subtests with the exception of motor encoding and auditory-vocal sequencing. Auditory-vocal sequencing is negatively related to chronological age ($r = -.45$) and the average chronological age of the mild group was 109.2 months, compared to 100.5 for the moderate group and 97.2 months for the severe defect group. Why the older subjects might have had more difficulty with auditory sequencing than did the younger ones is difficult to determine, unless this ability is highly important in educational achievement and those deficient in it were older as a result of educational retardation, having been likely prospects for special class placement with minimum qualifications—in this case, very mild visual defects.

Although all of the groups were low in motor encoding, this was the only subtest in which the mild defect group scored higher than either of the other two groups. As was discussed previously, visual defect per-

haps affects motor encoding by limiting the child's visual experiences of his non-immediate environment. The child with the mild visual defect was least limited in this regard.

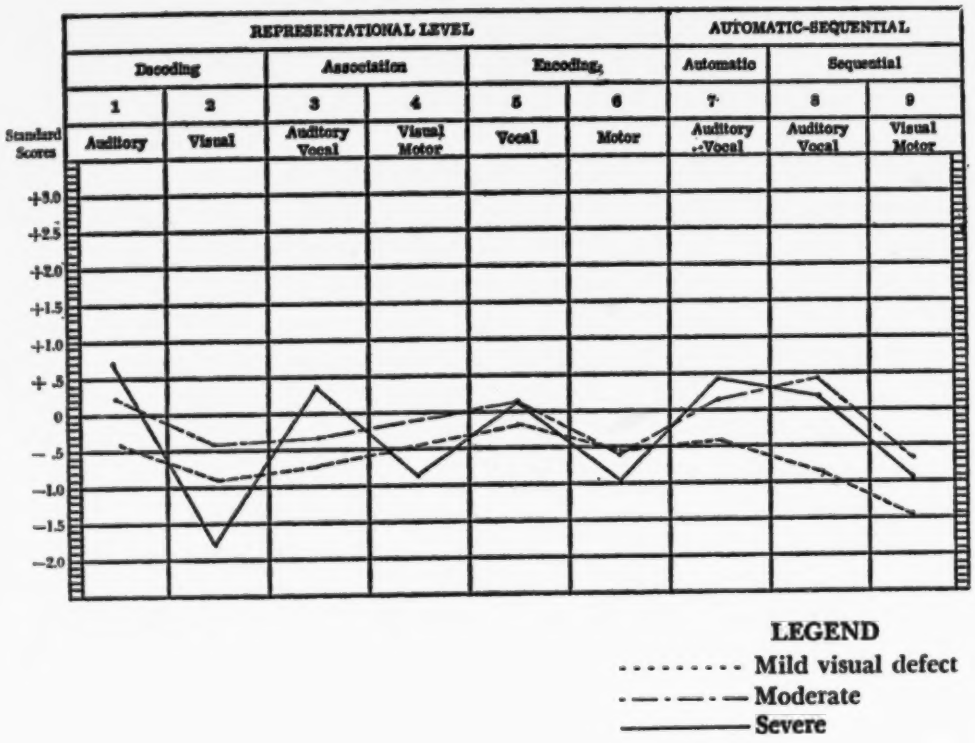
The subtests which correlated most highly with intelligence were auditory-vocal association ($r = +.68$) and auditory-vocal automatic ($r = +.68$). It was on these subtests, plus auditory decoding, that the differences in intelligence among the three groups were most clearly seen.

The visual channel deficit shown previously in the total group (N = 93) ITPA profile, Figure 2, is seen in Figure 3 to be largely attributable to the small group of severe visual defect children, most of whom were legally blind. Even though the mild and moderate defect groups still score below the standardization group on the visual channel subtests when scores are based on the mental ages of the partially seeing subjects, it is clear from the profile that they manifest generally lower performance on all tests, and clinically do *not* show a visual channel deficit; i.e., visual subtest performance is not strikingly or consistently lower than auditory subtest performance.

The profiles of the mild and moderate defect groups (vision 20/20

FIGURE 3

ITPA and Degree of Visual Defect



through 20/200) suggest that the ITPA is suitable for use with the visually handicapped, and that the visual processes involved in this test are not exclusively peripheral. The severe and moderate defect groups performed better than the mild defect group on the visual-motor sequential subtest. However, when subjects with less than 20/200 vision are tested, an allowance should generally be made for lowered visual channel performance.

Profiles were drawn for each eye condition and several combinations of conditions. Since the number of cases represented on each profile was small the profiles are not presented here. The children with cataracts and retrolental fibroplasia showed highly similar profiles and both presented clear cases of visual channel deficit, as they were among the most severely visually handicapped. The effect of their profiles was seen in the contrast between the total refractive and non-refractive group profiles. The refractives, who were less severely handicapped, showed no major visual channel problems.

Children with refractive errors showed no deficit in visual-motor association, suggesting that with visually handicapped children who are not legally blind (as the great majority of refractives are not), this subtest was measuring central processes that were relatively unaffected by sensory loss. The lack of discrimination between the types or degree of visual problems shown by the tests of motor encoding (except as discussed earlier) and visual-motor sequential abilities suggests that the lowered performance in these areas was a function of limited visual experiences, not of the test material. It thus appears that visual decoding was the only subtest which was clearly affected by the difficulty in performing the visual task required or presented by the test material itself.

In general, it may be said that degree of visual defect, rather than type of eye condition, exerts the greatest influence on the ITPA profiles of these partially seeing children.

Psycholinguistic Processes and Reading

The relations between both reading achievement and error types in reading and performance on the ITPA were studied. In addition to these analyses, several case histories are presented as illustrations of these relations.

Reading Achievement

Both reading test scores and ITPA scores were available for 59 partially seeing subjects. When the discrepancy between mental age and reading age was used as the index of reading achievement, no significant correlations were found between reading and performance on the

ITPA. However, mental age is not considered an adequate single criterion for the evaluation of reading expectancy for these children, as was discussed earlier.

When grade placement was used as the criterion for reading, and correlations were computed using the deviation of reading grade from grade placement, reading achievement was found to be positively related to the auditory-vocal sequential subtest ($r = +.44$), visual-motor sequential subtest ($r = +.35$), and the auditory-vocal automatic subtest ($r = +.43$). The second graders were excluded from this analysis since the reading tests were administered to the more advanced readers only. The N was thus reduced from 59 to 42.

Psycholinguistic Subtests and Error Types

Correlations were computed between each error type and each ITPA subtest. It was not necessary to exclude the second graders from this analysis, since error standard scores are based on average reading grade. Only twelve of 110 correlations were significant ($p < .025$), and all of these correlations were very low ($r = .25$ to $.30$).

The relations discussed in the following section are merely suggestive and are not to be considered as necessarily or generally applicable. However, as will be shown in illustrative case history material, these relations may be crucial in individual cases. Restandardization of the error type norms and the use of a larger sample would be necessary to justify a more vigorous statistical treatment of these data (e.g., factor analysis).

Auditory-vocal and visual-motor sequencing. Auditory-vocal sequencing subtest scores were positively related to high words aided and refused ($r = .28$). This may be a result of the relation between high reading achievement and auditory-vocal sequencing. Possibly the better readers are more reluctant than the poor readers to read an unknown word incorrectly. If this were so, a negative correlation of approximately the same magnitude would be expected between substitutions and auditory-vocal sequencing. Such a correlation was found ($r = -.30$). Substitutions also were correlated ($r = -.26$) with visual-motor sequencing. Consonant errors were negatively correlated with both auditory-vocal and visual-motor sequencing ($r = -.27, -.25$). As was suggested earlier, consonant errors may reflect general level of reading better than do other types of errors, and as noted in the preceding section, both sequencing subtests were also positively related to reading achievement ($r = +.44, r = +.35$). Of the twelve significant correlations found, five involved one of the sequencing subtests, suggesting that sequencing is more directly related to reading than are other abilities measured by the ITPA.

Motor encoding. High motor encoding was related to high vowel errors ($r = +.28$) and to low words aided and refused ($r = -.29$). A personality factor or pattern could operate similarly to facilitate motor encoding performance and to make a child reluctant to sit passively and wait to be told an unknown word. No reason for a genuine relation between high motor encoding and high vowel errors was discernible.

Auditory decoding. Auditory decoding correlated positively with high repetition errors ($r = +.29$), suggesting that the child who operates on a level of high understanding of the spoken word, as a child high in auditory decoding ability does by definition, also insists on obtaining meaning from material he reads orally and often resorts to repeating himself in order to get the meaning of difficult material.

Total ITPA scores. Total ITPA score was negatively related to substitution errors ($r = -.26$) and to consonant errors ($r = -.30$). These relationships would logically follow from assuming that the better readers tend to make fewer *basic* errors (substituting entire words and confusing consonants) than do poor readers, and that those who have the highest over-all language performance are the better readers.

Case History Material

The ITPA is a new test, and as yet has not accumulated an extensive background of "clinical lore" regarding its use with individual cases. Below are a few case histories chosen to illustrate the ways in which the ITPA and the Monroe reading analysis can supplement each other, to exemplify points mentioned in earlier discussion, and to show the inevitable exceptions to the generalizations derived through a study of this type.

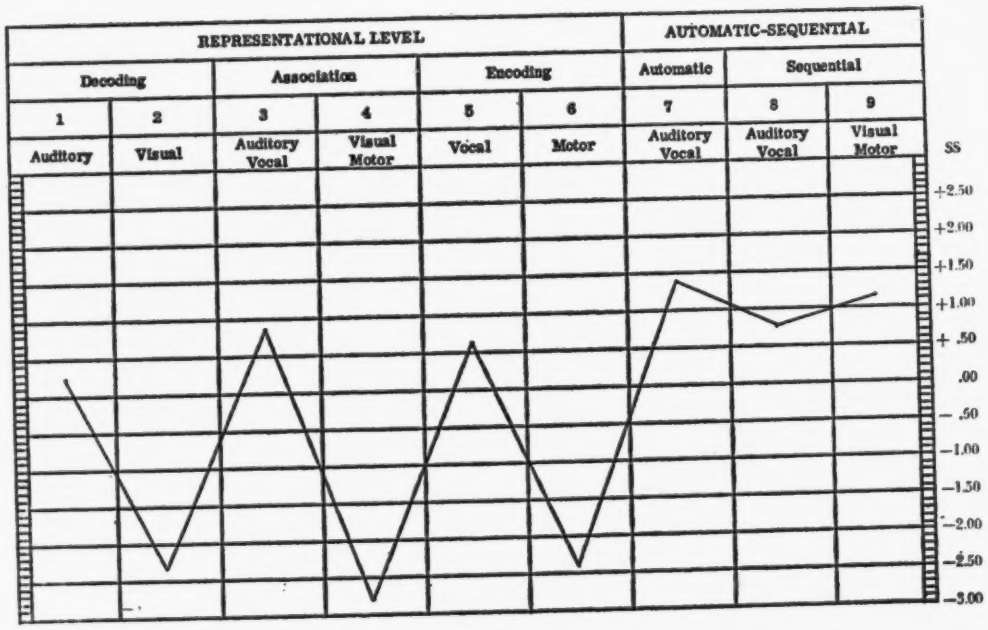
Case 1

TM, male, third grade, IQ 109, MA 9-6, CA 8-3. Cataract in right eye, nystagmus. Limited field. Visual acuity in right eye 20/75; left eye, light perception only. Showed extreme difficulty in visual tasks.

TM's ITPA profile (Figure 4) shows a severe visual channel deficit. Only two or three other subjects presented a profile so clearly indicating the visual difficulty. Yet, even with the magnitude of the visual channel deficit, visual-motor sequencing is up to the level of the auditory-vocal channel. This profile supports the observation that performance on the visual-motor sequencing subtest does not necessarily depend on peripheral visual functions. Since the auditory-vocal automatic, auditory-vocal sequential, and visual-motor sequential subtests, which constitute the automatic-sequential level and correlate with reading, are high, we might expect that TM, in spite of his severe visual problem, would be capable of reading up to grade level.

FIGURE 4

TM



TM's grade placement scores and error profile indicate that he is reading almost a year above his grade level, makes no more total errors than the test standardization group, and many fewer errors than the partially seeing or the comparison groups. When he does not know and cannot sound out a word, he waits to be told the word and thus he makes few errors of any type other than words aided and refused.

Case 2

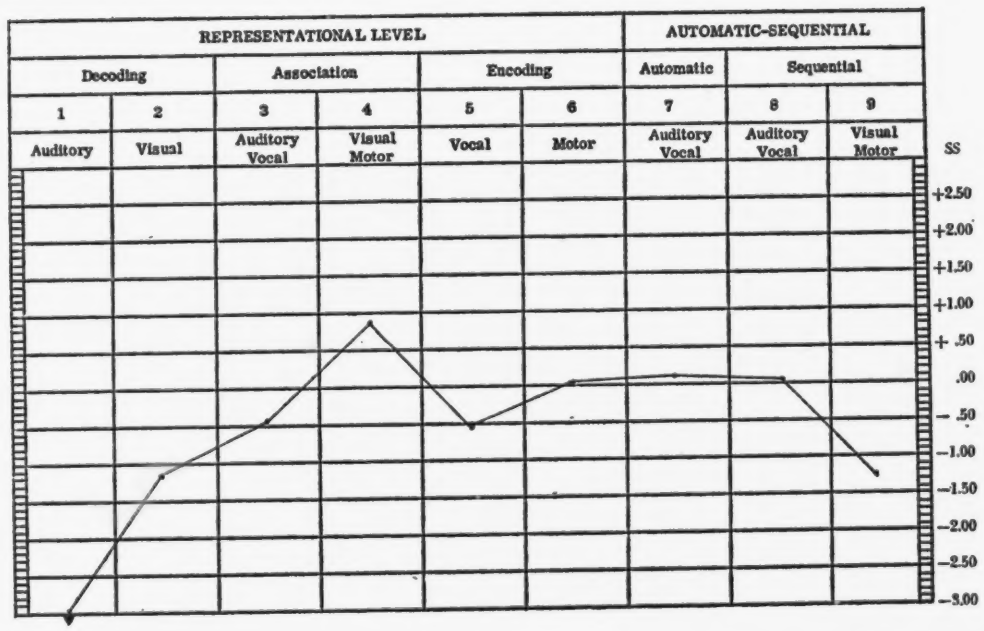
CS, male, third grade, IQ 105, MA 8-6. Has myopia, visual acuity 20/30 in both eyes. Evidenced no visual difficulty in any task.

Although CS's ITPA profile (Figure 5) shows some discrepancy between visual-motor sequential and other subtests, his deficit appeared clinically to be primarily a decoding process problem, rather than a channel difficulty.

He read almost two years above grade level and made few total errors compared to the total partially seeing group. The question may be raised as to why this boy was placed in a special program for visually handicapped children. A partial answer may be found in his ITPA auditory decoding performance. He responded incorrectly to these questions: Do pincushions cheer? Do daughters marry? Do dials yawn? Do frankfurters frown? His language age on this subtest was below four and one-half years. His earliest failure on the Binet was in verbal

FIGURE 5

CS



absurdities, and his lowest reading grade was in comprehension of silent reading.

We often think primarily of reading achievement as indicative of school standing, but in the case of CS, it is clear that how well one understands verbally presented material is also very important. In spite of his excellent reading performance, CS was seen by the school personnel as a child who was having such difficulty with his schoolwork that special class placement was necessary.

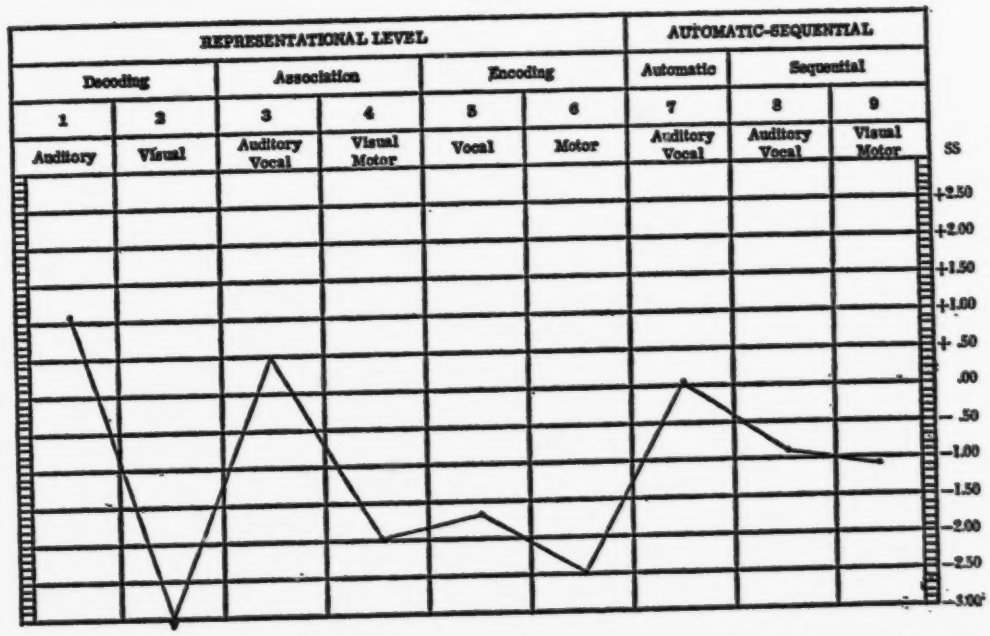
Case 3

MH, female, third grade, IQ 73, MA 6-0, CA 8-2. Optic atrophy, visual acuity 18/200 both eyes (legally blind).

This ITPA profile (Figure 6) presents a combination of visual channel and encoding process loss, with auditory-vocal automatic intact and the sequential scores not as deficient as visual decoding, vocal encoding, and motor encoding. This suggests that reading may not be seriously impaired. Her reading grades were: oral, 2.9; silent, 2.4; word recognition, 3.0; word discrimination, 3.2; average, 2.9. The Monroe profile and scores showed that in fact this child was reading only three months below grade placement and two years above her mental age as obtained on the Binet. The reading comprehension score was one-half year below the other reading test scores, consistent with the higher correlation found between mental age and comprehension as compared with the

FIGURE 6

MH



other facets of reading. And yet, the total reading performance suggested that the obtained mental age was too low. The error profile showed that the subject tended to refuse or to substitute words and made few vowel, consonant, and total errors.

If we hypothesize on the basis of the results obtained on the ITPA that MH's basic problem is in encoding and that her performance on the Binet is hampered by this problem, then the high substitutions and refusals become indications that the subject was unable to express a word which she may have decoded quite correctly. The relatively low reading comprehension score may be due to an inability to execute the tasks required on the test, even though the directions may have been thoroughly understood. The Binet performance offered some support for this hypothesis. Her attempts to draw a diamond are shown in Figure 7.

The optic atrophy, encoding disability, and the low IQ may all be manifestations of a condition which was medically diagnosed (tentatively only) as a very mild case of cerebral palsy, type unspecified.

Case IV

KM, male, first grade, IQ 122, MA 8-0, CA 6-7. Cataracts, aphakia, capsular remnants. Visual acuity unknown.

KM was blind from birth, according to the report of the teacher, until surgery was performed within the past year. His parents and younger sibling are all blind. For the past year, six-year-old KM has literally

FIGURE 7
MH-Diamond

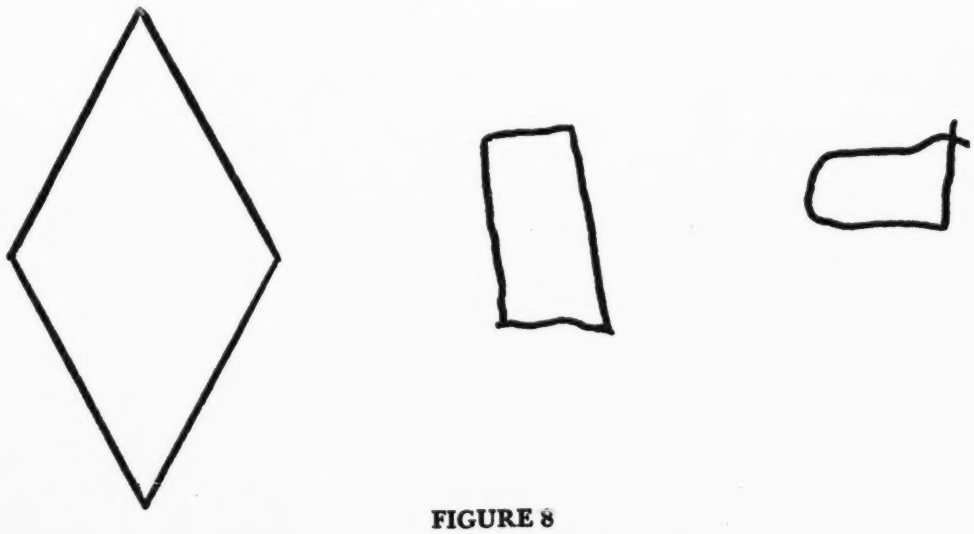
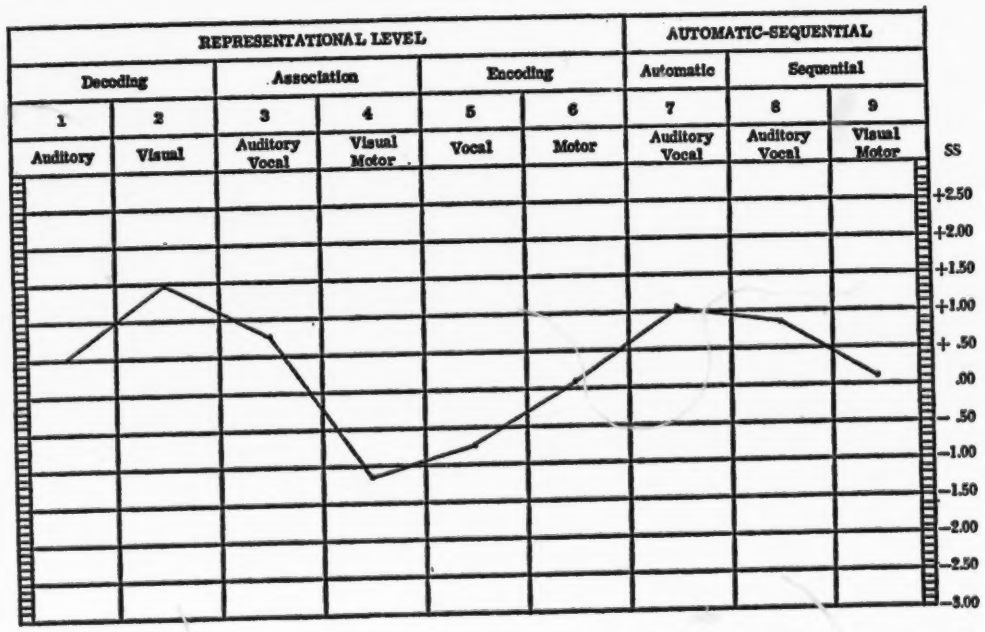


FIGURE 8
KM



served as the "eyes" for his entire family. His ITPA profile is extremely interesting. Visual decoding was his highest subtest, while visual motor association was the lowest. Circumstances have literally compelled KM to learn to understand what he sees—visual decoding—and he has had the mental ability to do this well and rapidly. Yet in spite of his success in doing this, he simply has not had enough visual experiences in his "year of sight" to build up the central visual associations measured by the visual-motor association subtest.

6 | Summary and Implications

The purpose of this study was to investigate the effect of visual defect on the reading and psycholinguistic processes of partially seeing children. Monroe Reading Examination scores, Illinois Test of Psycholinguistic Abilities profiles, and Stanford-Binet Intelligence Scale scores were obtained for the 131 partially seeing children enrolled in grades one through four in twenty Illinois resource and special class programs for the partially seeing.

An examination of the grade, sex, IQ, visual acuity, and eye condition of the 131 partially seeing subjects revealed:

1. The ratio of boys to girls was three to two.
2. The intelligence test scores were essentially normally distributed, with a mean IQ of 100.
3. About 40 percent of the children had mild visual defects (visual acuity $>$ 20/70 in the better eye), about 40 percent had moderate defects (visual acuity 20/70-20/200), and 20 percent were legally blind (visual acuity $<$20/200).
4. The girls were more seriously visually handicapped as a group than were the boys.
5. The children with refractive errors (about 40 percent of the sample) tended to be less severely visually handicapped, to be older, and to have lower IQs than the children with other types of eye conditions.

Reading Achievement

Analysis of the reading test scores showed:

1. The fourth graders read 3.5 months below grade level, while the third graders read at grade level.
2. Partially seeing children scored lowest on oral reading, and highest on the Gates silent reading comprehension tests. The latter are typical of the reading achievement tests most commonly used in schools to evaluate reading performance. On these tests the third graders read about one month above grade level, and the fourth graders were two months below grade level.
3. The total group of partially seeing children read an average of six months below mental age, and less than one-half month below grade placement.
4. IQ was positively related to reading in relation to grade level, but negatively related to reading in relation to mental age.

5. Speed of reading was about two months below the average reading grade, but accuracy was higher than for normal children.

Reading Processes

There was slight evidence that partially seeing children have more trouble with vowel discrimination than they have with other kinds of errors, but it was impossible to determine whether this difficulty exceeded that of normally seeing children. If the criterion of exceeding both comparison groups is used, the partially seeing did not make excessive errors of any kind.

Reading and Visual Defect

Investigations of relations between reading and visual defect showed:

1. No significant differences were found between the reading achievement of the mild, moderate, and severe visual defect groups, but there was a tendency for the mild defect group to read less well in relation to grade placement than did the moderate and severe defect groups.
2. Children with refractive errors read less well than did those with other types of eye conditions.
3. No significant differences were found between the error types made by the mild, moderate, and severe visual defect groups, but there was a tendency for the mild defect group to make more errors of all types except words aided and refused.

Psycholinguistic Processes

The ITPA scores of 93 partially seeing children were compared to the test standardization group and related to IQ and visual problems. These comparisons showed:

1. Partially seeing children as a total group performed significantly less well than normals on visual decoding, motor encoding, visual-motor sequential, and visual-motor association subtests of the ITPA and did not differ from normals on the auditory-vocal channel subtests.
2. The children with severe visual defects showed a marked visual channel deficit which was less apparent for the mildly and moderately handicapped children; the latter showed only a mild visual decoding deficit and no visual-motor association deficit.
3. ITPA performance was related to eye condition only through the indirect effect of visual acuity.

Reading and Psycholinguistic Processes

Correlations between reading and psycholinguistic processes revealed

that reading achievement was positively correlated with the three ITPA subtests at the automatic-sequential level—auditory-vocal sequential, visual-motor sequential, and auditory-vocal automatic.

Implications

In the absence of any evidence to the contrary, the partially seeing children in this study are considered representative of partially seeing children, grades one through four, enrolled in public school special programs wherever admission to these programs is based on criteria similar to those in Illinois. The implications of the findings of this investigation may presumably be generalized to other partially seeing children of similar age and educational status.

Educational Diagnosis and Evaluation of the Reading Level and Processes of Partially Seeing Children

The reading tests utilized in this study are appropriate for use with partially seeing children without enlargement and without extended time limits. There is no reason to expect reading retardation among partially seeing children, provided that suitable materials and appropriate instruction have been available to them from the beginning of their reading instruction. Unfortunately, no data were collected on age and educational status at the time of admission to special programs. However, data have been presented which suggest that the slight reading retardation found with these children as a group, especially the fourth graders, is the result of the low reading achievement of a small group of children with very mild visual problems who have been placed in special classes primarily because of a possible learning disability rather than actual visual difficulty.

The Monroe Diagnostic Reading Examination provides a useful framework for analyzing reading errors made by an individual child, but its usefulness as a research tool is seriously limited by the inadequacy of the norms. The error profile presented in this study, based on an analysis of the reading of 96 partially seeing children, is considered a more adequate frame of reference for future evaluation of reading processes of partially seeing children than is the standardization group. The Monroe test is particularly well suited for clinical use with visually handicapped because, while most of the print is large and very legible, at the same time a wide range of print sizes are employed in various sections of the test.

Educational and Psychological Diagnosis of Psycholinguistic Processes of Partially Seeing Children

The finding that partially seeing children as a group show a visual

channel deficit is subject to important qualifications: (a) the deficit shown by the group as a whole was due primarily to the influence of the small group of severely visually handicapped, most of whom were legally blind; (b) the mild and moderate defect groups showed no visual-motor association deficit whatever, strongly suggesting that the test is measuring central rather than peripheral processes; and (c) the motor encoding test seems particularly sensitive to, and hence an excellent gauge of, the extent of limitation in visual experience in a child's background.

The ITPA appears to be an excellent diagnostic aid to be utilized in determining level and mode of visual functioning in partially seeing children. The inadequacies of visual acuity notations and purely subjective evaluations to describe visual functioning have long been noted by teachers of the partially seeing.

Implications for Teaching Partially Seeing Children

No evidence was found which would in any way justify serious criticism of methods of teaching reading employed with the partially seeing children. However, a few minor suggestions might be made: (a) increased emphasis on visual discrimination of vowels; (b) concentration on reading all the visual symbols presented in order to decrease a tendency to omit sounds and words; and (c) particular effort to eliminate faulty eye movements, within whatever limitations exist because of eye conditions, in order to attain maximum speed.

The ITPA performance of these children suggests that many partially seeing children need help in interpreting or obtaining meaning from visual symbols. Although specific techniques for remediating this deficiency or strengthening the function are only now being devised and await evaluation, classroom teachers can experiment independently in this area. A further recommendation based on the ITPA results with partially seeing children is that they should be given special help and experience in expressing ideas motorically. To the extent that many meaningful gestures in our society are typically observed from a distance only, these gestures and actions must be brought close to the children, or they to them.

Implications for Further Research and Theory

1. The relative roles of severity of visual impairment and degree of learning disability or academic difficulty in admission to special programs for the partially seeing should be investigated and evaluated.
2. Reading achievement of partially seeing children may be heavily influenced by factors operating within a given classroom or school

system. The role of such factors as type of program (special class or resource room), method of reading instruction, grade span encompassed within a room, time spent and subjects studied in the regular classroom, and so forth, may influence level of reading, as suggested by the finding in this study that average reading achievement ranged from a year above grade level in one class to a year below grade level in another.

3. The commonly accepted practices of enlarging test materials and extending the time limits for testing partially seeing children should be re-evaluated in the light of this and other studies.
4. The apparent relation between reading achievement and the abilities tapped by the three automatic-sequential subtests of the ITPA should be more fully explored, both in relation to visually handicapped and non-visually handicapped children.
5. Further work should be done toward investigating relations between specific reading and psycholinguistic deficits in individual children, and planning remedial techniques for these disabilities.

Two somewhat provocative suggestions from this study involve the ITPA: (a) reading success may be related to the abilities assessed by the automatic-sequential level subtests and (b) minimal sensory intake may be sufficient for near maximal central efficiency, as shown by the fact that the partially seeing children (exclusive of the severely handicapped and/or legally blind) did not necessarily show a visual channel psycholinguistic deficit.

If one assumes that the relationship between success in reading and the automatic-sequential level functions (in which the level of organization within the individual is that required to mediate activities involving the retention of symbol sequences and "automatic" habit chains) is genuine, questions may be raised as to why this relationship should obtain and what are its implications. Discussions about the reading process often center on the element of "meaning," perhaps at the expense of the observation that initially the printed symbols (letters) are actually quite arbitrary and without meaning. If a child has difficulty in manipulating relatively meaningless symbols he may then be unable to attach meaning to them. Perhaps a clue to both the basic nature of the various techniques of remedial reading instruction and the lack of differentiation among the results obtained by them is found here. The techniques, whether predominantly phonic, visual, or kinesthetic, involve increasing the ease with which the child can manipulate the letters (symbols) themselves. If the reason for learning disabilities in reading lies in automatic-sequential level deficits, rather than in channel or process deficits, then the channel and method used in

remediation become less important than the fact that the symbols themselves are extensively manipulated.

If the suggestion from this study that central processes are not necessarily grossly impaired by limitations on sensory input is sound, the implications for special education are profound. Even though the end organ may be defective and grossly limit the sensations received centrally, the central processes can perhaps "step-up" the magnitude of stimulation (a suggestion not without some support from recent neurological investigations of central influence on sensory stimulation) or accuracy of perception. Perhaps further research along this line of speculation could lead to a description of the association (central) process as that function by which (or area in which) sensorily received stimulation can cross channels and by which intensity of stimulation can be increased or decreased. Speculative, theoretical justification has thus been presented for continuing with increased zeal an already established precept of special education—helping each child use *centrally* what he has *peripherally*.

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